DOCUMENT RESUME

ED 356 568 EA 024 835

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TITLE An Overview of the Problem of Relevance in Education.
PUB DATE Nov 92
NOTE 11p.; Paper presented at the Annual Meeting of the Mid-South Educational Research Association (Knoxville, TN, November 1992).
PUB TYPE Viewpoints (Opinion/Position Papers, Essays, etc.) (120) -- Information Analyses (070) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Cognitive Style; *Educational Change; Educational Theories; Elementary Secondary Education; *Learning Processes; *Learning Strategies; *Learning Theories

ABSTRACT

Education has been in a perpetual state of reform seeking "far reaching changes in weary practices, outmoded assumptions, and long-assumed constraints." This approach must be examined to keep the same old problems from resurfacing and making reform efforts ineffective. Common suggestions for educational reform involve stricter standards, procedures, or accountability measures. But it is questionable that these measures are effective. Even changes in teacher training, experiences, personality, or attitude have been found to have a negligible effect on student learning. Education reform must follow the example of medical science and recognize that at the core of knowledge is an understanding of how biological systems function. Recent research on how the brain functions suggests that such knowledge would be helpful in sorting out relevant and irrelevant educational reform efforts. Two promising knowledge theories are the theories of "autonomy of knowledge" and "simplification by isolation." Autonomy of knowledge holds that knowledge has a separate existence outside the physical nervous system. Simplification by isolation says that complex knowledge structures can be broken down into manageable smaller pieces. Biofunctional theory accepts the proposition that nervous systems demand that learning be done within the context of whole experiences. Acknowledging this fact is important to identifying relevant and irrelevant educational practices. (Contains 24 references.) (JPT)

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An Overview of the Problem of Relevance in Education

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Abstract

Education has been in a perpetual state of reform seeking "far reaching changes in weary practices, outmoded assumptions, and long-assumed constraints" (America 2000, 1990, p. 5). Recognition of the need to change is necessary but not sufficient. What makes existing assumptions or practices outmoded? What kinds of alternatives ought to replace them? And what makes the alternatives more relevant? Without answers to these questions, old problems are likely to resurface to make the process of reform ineffective. Education today can no more systematically separate fact from fiction than could medicine prior to modern medical sciences. Then, deadly epidemics routinely wiped out populations because the information needed for distinguishing relevant and irrelevant practices was unavailable. Like early medicine, education is in many ways still in the beginning stages. Modern medical sciences now have reached a new level of understanding that can systematically separate practices that are relevant to disease prevention and cure from those based on irrelevant superstition. At the core of this understanding in medicine lies knowledge of how biological systems function. Recent developments in the literature on how the brain functions suggest that a similar level of understanding for sorting out relevant and irrelevant schooling practices may be possible in education. The presentations in this symposium examine some of the classroom application of the notion that relevance in education is, as in medicine, biological in nature.

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Discussion Questions about the Problem of Relevance in Education

1. Consider the following common measures of educational reform: longer school days, longer school year, smaller classes, higher standards, higher teacher salaries, achievement testing. Which one of these can result in more effective schools with a moderate degree of certainty?

2. Think back for a moment to good old days before the development of modern medical sciences, when faith healing, blood letting, and fetishism were practiced to cure diseases. Then it was difficult to separate relevant medical practice that resulted in curing diseases from irrelevant practices. As a result, epidemics routinely wiped out entire populations. Can educators today distinguish between those practices that are relevant to the educational process from those that are irrelevant any better than medicine did prior to the development of modern medical sciences?

3. Schon claims that professional knowledge in education does not generalize to the soft and slimy context of real-world educational practice. To what extent is this lack of generalizability due to the fact that we cannot distinguish relevant from irrelevant educational practice?

4. No presidential candidate would try to convince voters that he/she is competent to tell surgeons how to perform in an operating room. Why is it then that some candidates feel that they can convince voters that they are competent to provide recipes for classroom teachers? To what extent is this due to the fact that it easy to appreciate what is relevant expert practice in the operating room but not in the classroom?

5. If the guesses that are made by nonexperts are as good as those made by expert, then would you not say that the bulk of the energy in that discipline should be geared toward changing that state of affairs?

6. Think for a moment about some possible ways of going about changing this state of affairs. In our research during the past 15 years, we have assumed that a breakthrough in problems of education is unlikely without some understanding of how the nervous system learns. How plausible is it to assume that relevance in education is, like in medicine, ultimately biofunctional in nature? What are some other strategies for an immediate attack on the problem?

7. It takes many years to train someone in medical sciences. Suppose we know the major biofunctional factors involved in relevant expert practice is in education. Relative to medical sciences, what period of training would you anticipate for teachers and other educators responsible for educational processes?

THE BIOLOGICAL NATURE OF EDUCATIONAL RELEVANCE

I. *Healthy Education With or Without Biology*

A. Without Biology

TRUE INFLUENCES ON THE EDUCATIONAL PROCESS ----------> WHATEVER APPEARS ---------> HEALTHY EDUCATION TO WORK

B. With Biology

TRUE INFLUENCES ON THE EDUCATIONAL PROCESS ----------> RELEVANT BIOLOGICAL PROCESSES ------> HEALTHY EDUCATION

C. The Biological Relevance Assumption: Understanding relevant biological processes is the only way to guarantee a healthy education

II. *Two Kinds of Educational Theories of Biological Relevance*

A. Cognitive Theories of Knowledge: Assumptions

The Hierarchical Assumption: Brain Organization = Knowledge Organization
The Processing Assumption: Brain Processes = Knowledge Processes

B. Cognitive Theories of Brain Functioning: Assumptions

Brain organization and knowledge organization are dramatically different
Brain processes and knowledge processes are dramatically different
Physical brain constraints are dramatically different from knowledge constraints

Normal Knowledge Processes Are Fallible: To Err Is Human
Normal Brain Processes Are Infallible: Evolution Tested

C. The Biofunctional Cognition Assumption: Educational relevance must be specified in terms of how biological systems function and not in terms of how knowledge is organized in the brain.

III. *Two Requirements of a Biofunctional Theory of Educational Relevance*

A. Must provide a total-picture understanding of how the nervous system functions
B. Must provide understanding of the nature of educationally-relevant factors

An Overview of the Problem of Relevance in Education

Education recently has been in a continuous state of reform seeking "far reaching changes in weary practices, outmoded assumptions, and long-assumed constraints" (America 2000, 1990, p. 5). Recognition of the need to change is necessary but not sufficient. Also necessary is understanding of (a) why outmoded assumptions are there to begin with, (b) what alternatives ought to replace them, and (c) what makes the alternatives more relevant toward a healthier and more prosperous education. Without such understanding, restructuring is likely to be analogous to repainting one's old car. Old problems and practices are likely to continue to resurface to make the process ineffective and wasteful. For instance, progress reports on restructured schools (e.g., Wehlage, Smith, & Lipman, 1992) indicate that most academic work in them "can be described as the repetition of drill and practice and the accumulation of fragmented bits of information with no apparent relevance to either real-world problems or the kinds of thinking tasks productive adults perform" (pp. 85-86).

The problem is finding a way to separate in a plethora of potential factors the kind that works because of inherent relevance to the educational process from the kind that only appears relevant because it happens to be there to fill an existing gap. Many educational reforms comprise such measures as "longer school day, longer school year, smaller classes, higher standards, higher teacher salaries, achievement testing, "tougher" textbooks, among others" (Marsh, 1992, p. 2). It is questionable, that effective schools can be built out of more strict standards, procedures, or accountability measures. As Marsh notes, even such teacher variables as training, experiences, personality, or attitude have negligible relationships to student learning.

So critical is the problem of relevance that solving it may be the only way to reach a genuine breakthrough in education. Today's education cannot separate fact from fiction systematically, perhaps no better than medicine could prior to the development of modern medical sciences. Then, deadly epidemics routinely wiped out populations not because they were inherently too complex to prevent but because access to relevant information was impossible at the time. There were, on the other hand, no limits on the growth and spread of superstitious information. So practices such as faith healing, bloodletting, and fetishism were common not for their genuine effectiveness but because they were there to fill frustrating gaps. Like early

medicine, education today is in many ways in its early stages. Fact and fiction are hard to separate as are sound practice and superstition.

The search for relevance is as imperative in research as it is in educational practice. Schon (1987) discussed the relevance of research-based professional knowledge to the authentic real-world practice. He argued that the search for rigor, at the expense of relevance, in scientific research requires that research-based professional knowledge always deal with simpler problems that respond well to the techniques of basic science but are inapplicable to the complex world of authentic practice. The real source of the problem to which Schon refers is the assumption of simplification by isolation also commonly held in both scientific and practical settings. Both the psychology experiment and the school curriculum focus on memory for isolated, concepts, facts, and definitions thereby fragmenting learning situations to such an extent to make them inapplicable to authentic real-world contexts.

Two Kinds of Theories of the Nature of Relevance in Education

Cognitive Theories of Knowledge

The first step toward understanding the nature of educational relevance is to examine closely the deep-seated assumptions behind current educational theory and practice. Two of the most seductive of these assumption are (a) autonomy of knowledge as a separate product and (b) simplification by isolation (Iran-Nejad, McKeachie, & Berliner, 1990; Iran-Nejad & Ortony, 1984). The first assumption holds that knowledge has a separate existence from the physical nervous system. As a result, it can exist in some complete form outside the learner and be internalized, stored, and reproduced at some later time. The second suggests that we can simplify complex knowledge structures for learners by breaking them down into manageable pieces for internalization.

Neisser (1967) used the computer analogy to illustrate how knowledge structures can, like computer programs, have a separate existence. Just as the computer processes any data for which it has a program in its software warehouse, people can process any information for which it has internalized a schema. As in the case of the computer, learning is no more than storing information for later retrieval. According to Neisser (1967), a researcher who talks about knowledge schemas is doing nothing contradictory just as one "who seeks to

discover the program of a computer is surely not doing anything self-contradictory" (p. 8). Moreover, one need not care about how the nervous system might store knowledge, just as a computer software scientist does "not care much whether his particular computer stores information in magnetic cores or in thin films" (Neisser, 1967, p. 6).

Presidential candidates never try to convince voters that they are competent to tell surgeons how to perform in the operating room. Why is it that they feel competent to provide recipes for classroom teachers and get away with it? Which is easier; performing a heart surgery or causing learning in a classroom of students. The answer is clear if we go by the reasonable criterion that easier problems are those whose solutions are discovered first. In the operating room, it is easy to appreciate what is relevant expert practice. As a result, no nonexperts dare to send in their quick fixes. So long as the problem of relevance is not resolved in education, we can expect everyone else to be an expert in classroom teaching but classroom teachers themselves.

The analogy holds not just for politicians but for researchers as well. Neisser (1967) would have never claimed that computer repairmen can perform heart surgery on human patients. Why do so many of us believe that the flow charts of the computer software scientists are the relevant stuff for practitioners in human learning? The answer once again lies in the fact that it is much clearer what relevant expert practices are in medicine than in education. To the extent that it is impossible to distinguish relevant expert practices from irrelevant nonexpert practices in education, we are faced with the serious problem of understanding the nature of educational relevance.

In late 1970s, several reviews of research on cognitive theories of knowledge appeared in the literature (Alba & Hasher, 1983; Black & Wilensky, 1980; Thorndyke & Yekovich, 1979). These reviews successfully challenged a set of assumptions that had plagued education since the days of Plato and that had gained renewed strength from the computer metaphor. The appropriateness of the seductive computer metaphor to human functioning was questioned (Bransford, McCarrell, Franks, & Nitsch, 1977; Jenkins, 1974).

So effective was the force of the criticism of the assumptions behind cognitive theories of knowledge that the pioneers in the field, whose research was carrying considerable momentum in the late 1970s expressed disenchantment with the theories that they had been advocating. Neisser (1976; 1978) expressed dissatisfaction

with the fact that information processing research had disregarded the human, social, and real-life aspects of memory; Anderson (1984) and others (see Alba & Hasher, 1983) questioned the wisdom behind the exclusive focus in educational research on abstract mental structures; and Rumelhart (1984) voiced disillusionment with the computer-inspired approach to human cognition and language. Consequently, there was a sudden decline in interest in cognitive theories knowledge. It is important for educators to examine carefully the developments that led to this decline.

Biofunctional Cognition

Alternatives to cognitive theories of knowledge have existed since late nineteenth century in the works of functionalists such as Dewey (1896), Angell (1904), and Bartlett (1932). The functionalist research shows a particularly striking modern flavor in its (a) rejection of the assumption of simplification by isolation, (b) its focus on how nervous systems have evolved to function in real-world contexts, and (c) its objection to viewing learning as the long-term storage of knowledge. Dewey (1896), for instance, noted that "it is always wise to beware of that false simplicity which is reached by leaving out of account a large part of the problem" (pp. 363-364). Similarly, Bartlett (1932) spoke of the dangers associated with the assumption of simplification by isolation and the benefits of the method of simplification by integration (see Iran-Nejad, McKeachie, & Berliner, 1990). The biofunctional approach shares these assumptions with the work of early functionalists.

During the past fifteen years, biofunctional cognition has slowly emerged as a different approach from cognitive theories of knowledge to provide us with a holistic way of thinking about the nature of educational relevance. Just as understanding how the immune system functions enabled medical scientists to solve the problem of separating relevant practices from irrelevant ones in disease prevention and cure, understanding how the nervous system functions is essential to distinguish between relevant expert and irrelevant nonexpert practices in education. The idea is that educational relevance is, like relevance in medicine, biofunctional in nature (see Iran-Nejad, 1980, 1987, 1989, 1990, Iran-Nejad & Chissom, 1992; Iran-Nejad, Clore, & Vondruska, 1984, Iran-Nejad, Marsh, & Clements, 1992; Iran-Nejad, McKeachie, & Berliner, 1990; Iran-Nejad & Ortony, 1984; Marsh & Iran-Nejad, 1992).

At the most general level, biofunctional theory is compatible with those approaches which maintain that learning occurs in whole-experiences and part experiences must be learned only in the context of whole experiences. The reason for this is that the nervous system works well in authentic contexts, when multiple sources are available to contribute to learning simultaneously. There is much evidence, on the other hand, that the nervous system works very poorly in piecemeal situations when information is only available to the learner in isolated fragments. Knowledge of how the nervous system functions enables us to see and judge for ourselves what the relevant factors and constraints are and how they work together to produce learning as it occurs in natural contexts.

The most important implication of biofunctional cognition is that it clarifies what is involved in relevant educational practice. However, even when relevant expert practices are clear to us as far as our understanding of the system is concerned, it is often a slow and time-consuming process to translate this knowledge into educational practice. It is important to keep in mind that one of the most difficult challenges is going beyond the irrelevant obvious even when the reasons for going beyond, as well as the nature of the alternatives, are clear.

Conclusion

It is difficult to imagine any solution to the problems of today's education without finding a way of solving the problem of separating relevant and irrelevant educational practices. Having worked for nearly two decades with the literature on how the nervous system functions, we are convinced more than ever that the only sure way to solve the problem of relevance in education is understanding how the nervous system functions. The most invigorating aspect of this challenge, however, is knowing that we are at a stage in biofunctional cognition when such an understanding is already available in the literature (see the special issue of Educational Psychologist on brain and education, which is forthcoming in December, 1992).

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